Preliminary Study for Possible Rehabilitation and Life Extension Programme of South African Power Plants

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Progress Through Technology
Study Methodology

- Only power stations equipped with Steinmüller Africa boilers were assessed for the most suitable station to conduct a detailed study on.

- A typical pulverised fuel coal fired power station reflective of a larger sample was selected for further theoretical assessment and desktop study.

- Operating and maintenance history were crucial inputs.

- Study focused on remnant life, life extension, improving availability and potential to increase efficiency and generating capacity.
Summary of Findings

- Boilers have exceeded design life
- Extensive creep and fatigue damage resulting in UCLF
- Coal calorific value lower than design basis
- Coal ash and moisture content higher than design basis
- Low ash fusion temperatures encourages slagging
- Excessive tramp air
- Poor mill performance (% of PF below 75μm)
- Increased abrasion wear due to high flue gas flow rates
- Efficiency limitations imposed by outdated materials
Summary of Findings - continued

- Feedwater temperatures lower than design due to under performing HP heaters
- Draught plant running at maximum load yet unit unable to generate 100% of MCR
- Condensor back pressure higher than design from 80% load case
- Turbine exhaust and bled steam conditions indicate decreased turbine efficiency
- Cooling water temperature higher than design
Rehabilitation and Life Extension

**Phase 1:** Investigate return to original design capacity and design life

**Phase 2:** Investigate options to increase unit generating capacity, availability, design life and cycle efficiency

**Phase 3:** Cross reference scope and costs of phases 1 & 2. Optimise solution
Study Recommendations

▪ Rehabilitate complete unit, re-use existing civil works
▪ Replace all pressure parts operating at elevated temperature with modern cladded material
▪ Increase boiler main and reheat steam temperatures
▪ Increase main steam mass flow
▪ Retrofit turbo-gen unit to utilise increased steam enthalpy
▪ Replace aged process equipment which have significant impact on cycle efficiency, e.g. HP heaters
Study Recommendations - Continued

- Reduce condenser back pressure (return to design by eliminating blocked tubes and fouling, rehabilitate CW cooling towers)
- Replace milling plant to deal with increased volumes of poor quality coal
- Reduce auxiliary power consumption (energy efficient motors in large consumers – mills, draught plant, ash handling)
- Install flue gas desulphurisation (FGD) and heat recovery
Conclusion

- A desktop study prompted by the constrained state of the national electricity grid has confirmed opportunities to rehabilitate existing aged power stations for life extension while improving cycle efficiency & increasing generating capacity.

- Detailed study of one power station realised an increase of 8% in generating capacity - approximately 50MW per unit.

- Across seven power stations with Steinmüller boilers: 2200MW.